

THE HOUSE-FLY

PAY·HIM·IN·KIND



KILL·ALL·HIS·CHILDREN.



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ILLINOIS DEPARTMENT OF PUBLIC HEALTH

FLIES

A Peril to Health and How to Get Rid of Them

He Who Maintains a Fly Breeding Place is a
Criminal According to the Principles
Of the Common Law

THE FLY IS A DANGEROUS ALIEN ENEMY.
DON'T LET HIM LAND IN YOUR
TERRITORY

Plan Your Campaign in the Spring—But Better
Late Than Never

DANGEROUS.

THE IMPORTANCE OF FLIES in the spreading of disease is seldom fully recognized, and where it is the measures for the suppression of the nuisance are frequently ineffective.

The list of diseases which may be spread by flies is both long and important. Experiment and observation have demonstrated this mode of possible infection in—

Typhoid, and
Paratyphoid fever;
Diarrhoea;
Dysentery;
Cholera;
Tuberculosis;
Diphtheria;
Smallpox;
Anthrax; and
Poliomyelitis (infantile paralysis).

They are credited with the spread of leprosy.

They carry the germs of Egyptian sore eyes.

They have been proven as an infective agent in a tropical disease called the yaws.

There is a fatal disease of horses and mules, the germ of which is a low animal form called a trypanosome. This organism is similar to, but larger than the organism of syphilis. It has been proven that this disease is spread by the common house fly.

It is also demonstrated that flies often carry the eggs of many intestinal worms, especially those of the tapeworm.

From the similarity of the germs of epidemic meningitis to those of poliomyelitis, both as to form and natural habitat in the posterior portion of the nose, we may also suspect that flies may be active agents in dissemination of the meningitis.

HOW FLIES SCATTER DISEASE.

FLIES SCATTER DISEASE GERMS in three ways. Bacteria and other disease germs may be carried from place to place on the feet, body and wings of flies; or the infected material may be eaten by the flies, and the germs may be perhaps multiplied in its body and then scattered in the "specks," which are nothing less than the fecal discharges. Particularly in this latter way an infected fly may continue to scatter disease for several days.

Experiments made with blowflies indicate that food may be infected by something akin to spittle. Blowflies that were permitted to feed upon syrup or milk through openings in a zinc plate so small that they could only insert the proboscis, thus infected the milk and syrup up to 26 and 28 days after feeding on infected material.

PROOFS.

THESE FOREGOING FACTS have been demonstrated in numerous ways. It has been shown that flies collected in congested areas in cities in England carried and contained from 800,000 to 500,000,000 bacteria that thrive in the air. It is instructive also to note that in these investigations it was found that flies caught in milk shops carried and contained more bacteria than those from other shops with exposed food in similar locations.

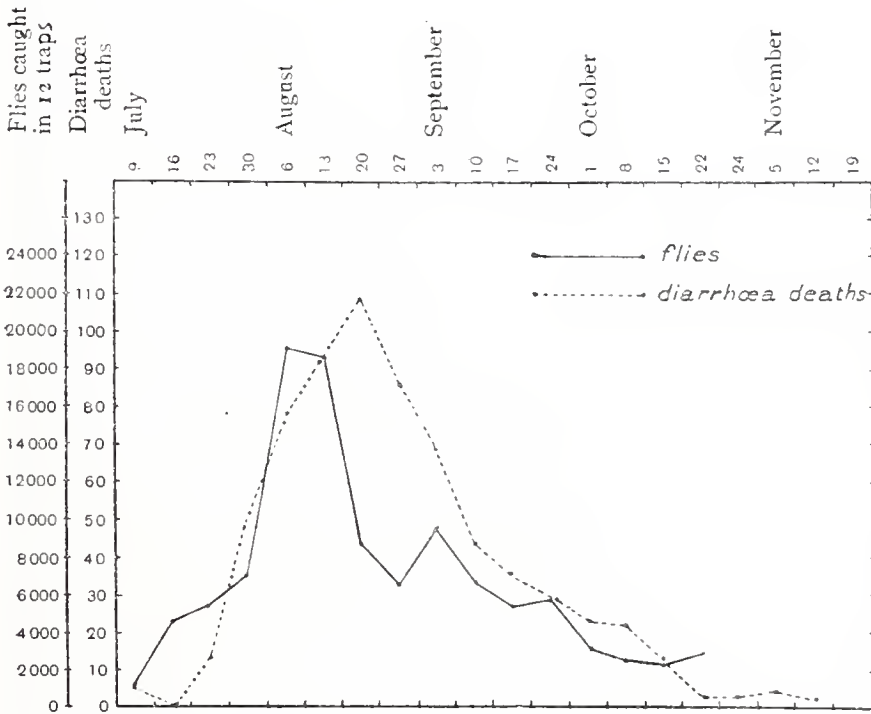


Fig. 1. Diarrhoea deaths and flies in Manchester in 1904. (From Graham-Smith, "Flies and Disease.")

Disease producing bacteria and protozoa have been taken from the outside and from the interior of flies. The eggs of intestinal worms have also been so found.

The occurrence of certain diseases has been found in nature associated with infected flies.

Finally by direct experiment flies have been proven as carriers of disease.

The presence of a bacterium known as the colon bacillus is generally accepted as evidence of fecal contamination. Flies caught in diarrhoea infested houses in Birmingham, England, were examined for this bacillus and from 25 per cent to 78 per cent of them, averaging 44 per cent, were found so infected. Similar investigations in Cambridge, England, showed 35 per cent infected. Typhoid bacilli were taken from wild flies in Chicago in a locality where it was suspected that the typhoid fever cases were caused by fly infection.

Niven, in Manchester, England, made daily counts of the number of flies caught systematically by bell-shaped traps baited with beer. By adding together the counts per week in all the stations he was able to construct the fly curve for the year. Comparing the curve with that

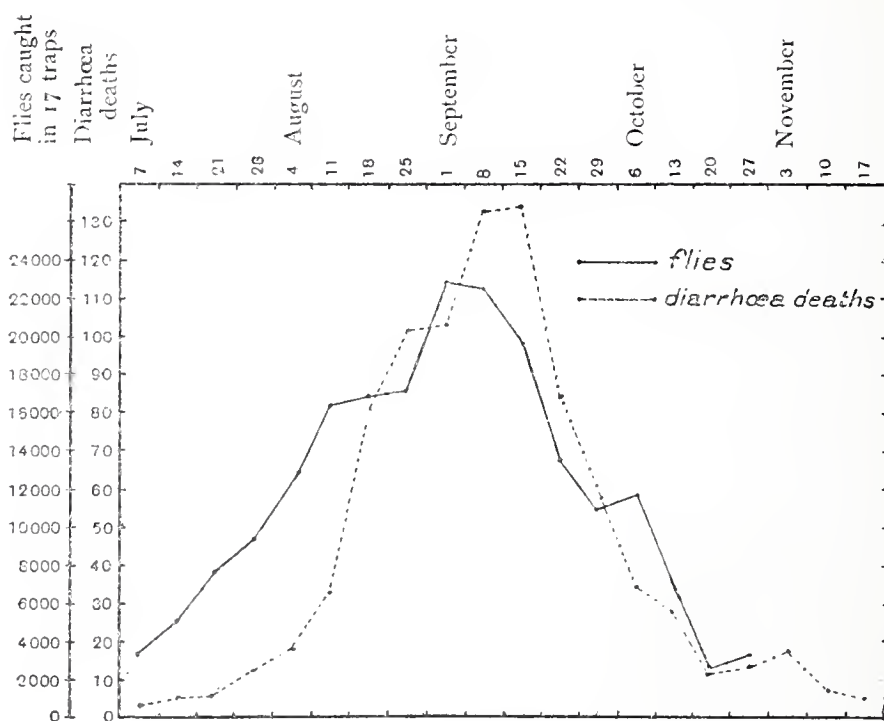


Fig. 2. Diarrhoea deaths and flies in Manchester in 1906. (From Graham-Smith, "Flies and Disease.")

of deaths from diarrhoea it will be seen that the death curve is about two weeks later than the fly curve, but that the two curves correspond very closely. Figs. 1 and 2.

HOW FLIES BECOME INFECTED.

FLIES ARE NATURAL FEEDERS UPON FILTH. They gorge upon feces and thus become infected internally and externally. From this natural source of infection it may be readily appreciated that flies are especially likely to spread intestinal infection.

They gather disease germs from cuspidors, and from the noses and mouths of patients, and from suppurating sores.

Other possible sources of infection must be remembered. Soil exposed to the bright sun for six hours after it had been wet with the urine of a typhoid carrier produced living typhoid bacilli, and the surface of ground covering typhoid discharges yielded living typhoid bacteria for forty days.

Sometimes when the maggots have fed on infected material the special germs may be recovered from the matured flies.

HOW FLIES INFECT.

SOMETIMES FLIES DIRECTLY INFECT PEOPLE by depositing the germs upon mucous membranes or the skin. Biting flies may infect through the skin. The more common method is by depositing the germs in or on articles of food, especially milk. Very frequently it is by depositing the germs upon empty dishes which in turn infect the milk or other articles of food later placed in them.

Milk, being a good culture medium for bacteria, is not only easily infected, but it may produce an enormous number of the germs in a few hours.

WHERE FLIES ARE DANGEROUS.

IN MODERN CITIES, supplied with suitable sewers and water closets, flies are relatively less important factors as disease propagators than they are in villages. In the cities they find less opportunity to become infected with the special germs; but even so, epidemics in cities may be caused by fly infection at some distant point. For example, an epidemic of typhoid fever occurred in the city of Washington. It was found that the victims had milk from two dairies. Both dairies received their supply from one farm. Everything about the milkhouse and the milk handlers was above suspicion. Then it was discovered that flies carried the infection to the milk cans hung out to air, from a privy 200 feet away used by a typhoid carrier.

In cities it is only the houses of the poor, as a rule, which depend upon privies. These houses are generally so poorly constructed that efficient screening is impossible. They are generally crowded with inmates, often so poorly nourished that they fall easy victims to disease.

Proximity of fly breeding places to privies and to the houses of the poor insures the occurrence of diarrhoea in the summer, and if a single case of typhoid or a typhoid carrier comes into the area early in the summer an epidemic of typhoid may be definitely predicted.

In a well-managed city the fly peril is relatively small because few flies are produced and chance of infection is slight, but that danger exists must not be forgotten. In a very clean Illinois city a diarrhoeal evacuation was found on the alley pavement within a few feet of the supply of green vegetables and fruits of a large grocery, and when seen the fecal material was black with flies.

CONTROL OF THE FLY PROBLEM.

THE FLY PROBLEM is not solved by screens, nor swatting, nor trapping, for they breed faster than they can be killed. A fly lays from 120 to 150 eggs at a time and may lay 600 in a season.

Care of garbage is not the solution for the garbage pail is only one of the fly restaurants. Extermination of flies depends chiefly upon the success with which their breeding is prevented, and these other measures are simply aids which are without much value by themselves. Intelligent warfare against this enemy must therefore be guided by a knowledge of fly habits.

LIFE HISTORY.

THE LIFE OF A FLY includes four stages, namely:

- Egg (fly blow).
- Larva (maggot).
- Pupa (sometimes called a grub).
- Imago (fly, full grown).

The time occupied in these changes in the common house fly depends largely upon the temperature, but a fair average is about ten days. It may be shortened in hot weather to about eight days and in colder climates it may be lengthened to four or five weeks, or perhaps even longer. Hewitt found as the shortest period for each stage of development that the egg hatched in eight hours; the larva went into the pupa case in four days and twenty hours; and the pupa became a fly in three days. In other words, the fully developed fly appeared in eight days and four hours after the egg was laid. If, therefore a manure pit is *cleaned*, not simply emptied, once a week no flies can mature in that pit.

BREEDING PLACES.

FOR BREEDING, flies seek warmth and moisture. Their preference is stable manure from horses. The large and rapidly growing pile is far less of a danger in this regard than the little pile in which it



Fig. 3. Eggs of House Fly. (U. S. Department of Agriculture.)



Fig. 4. Eggs of House Fly on Manure. (U. S. Department of Agriculture)
Natural size.



Fig. 5. Eggs of House Fly, much enlarged. (U. S. Department of Agriculture.)

takes two months for the blacksmith shop to accumulate a wheelbarrow full. The outside of the large pile is too fresh to produce flies easily and the inside is so heated that it kills the maggots. The small pile furnishes plenty of food, moisture and warmth for prolific production. The substitution of the automobile for horsepower has incidentally greatly reduced the fly nuisance in town.

Flies breed in any fecal masses—cow manure, human discharges, especially diarrhoeal, and street sweepings. For this reason when street sweepings are used for filling vacant lots in residence districts, the dump must be most carefully watched by an expert fly hunter.

Piles of wet straw, the grass collected by the lawn mower, accumulations of wet paper or partially decayed rags, all serve for the development of flies. Garbage, unless permitted to remain long in a pile or in the can, serves more freely as food for the developed fly rather than as a breeding place, but the garbage soaked earth, or the ground saturated with the drainage from the manure pile may often be found alive with the maggots.

The eggs of the house fly are small white cigar-shaped objects, generally laid in masses on the surface of the pile. Figs. 3, 4, and 5.



Fig. 6. Larvae of House Fly, natural size. (U. S. Department of Agriculture.)

The little white maggot comes out of the side of the egg after a few hours and begins immediately to hustle for food. Fig. 6.

In a few days, having reached full growth it naturally seeks the lower part of the pile or the ground and throws off its white coat, going to sleep in its pupa case, which looks like a little brown egg. Fig. 7.

A fly emerges from the pupa fully grown. The little flies found around manure or on fruit are not baby flies which grow later to become houseflies. If the larvae are underfed, or pass into the pupa stage too soon the resulting flies will be stunted in size. Generally the small flies belong to a different family.



Fig. 7. Larvae and pupae on old rag, natural size. (From Graham-Smith, "Flies and Disease.")

When the housefly emerges and dries his wings it may, at its first attempt, fly 400 or 500 feet. With the wind it may go farther, and after resting it is almost sure to go farther. Often it is carried for miles upon the body of a horse or cow, on trains or wagons. A garbage wagon, kept in the usual insanitary way, spreads swarms of flies throughout its travels.

If watch is kept as to on which side flies first appear at a house or at a camp, especially before a storm, it will generally be found that within 500 feet from that side there is a fly breeding place. Practical entomologists in that way have little difficulty in locating the trouble.

FLY BREEDING IS A PUBLIC NUISANCE.

A PERSON WHO CREATES OR MAINTAINS a public nuisance is indictable at the common law. Now that it is known that flies are important agents in the spread of disease it must be recognized that

a breeding place for flies is a public nuisance. It has been decided in a high court that a fly breeding manure pile in a town is such a public nuisance. The person creating or continuing such a pile is a criminal and may be punished even though there be no statute or ordinance which he has violated. This point is too frequently overlooked. While it may not always be advisable to prosecute such offenders, every citizen who maintains a fly breeding place should regard himself, and should be regarded by the community as a public criminal. He is a peril to the community for in effect he is threatening the health of his neighbors.

Further, a public nuisance can not be condoned by any enactment. Even though a city or village ordinance provides how manure, garbage, piles of waste, etc., shall be kept, such ordinance must be held illegal if it permits the development of flies. It may be held valid, however, until it is shown that compliance with it does tend to the production of flies. In other words, an ordinance is not valid if it violates the common law.

Energetic measures against fly production need not wait for the passage of an ordinance. They should begin at once, but proper enactments will be found helpful.

ANTI-FLY CAMPAIGN.

AN ANTI-FLY CAMPAIGN must, to be most efficient, include education, legislation and energetic executive enforcement. Most people offend because they do not know better. They see the outside of a manure pile but their attention has never been called to the maggots, or they do not know that the wiggling white maggots become flies. A baker prided himself with the care which he took to empty his manure box once a week, and he was indignant and wrathful when he was told that he was maintaining a fly breeding pit; yet through the entire summer that pit had been used for demonstration by an instructor. The pit was well constructed with a brick bottom. The fact was that though the manure was hauled away each week, the pit was never *cleaned*. It contained a few inches of litter at the bottom, especially in the corners, rich in fly larvae. When the baker realized this fact he made humble apology for his wrath, and thereafter the instructor had to find another place for his demonstration.

Ignorance is the first hindrance and it must be removed.

Ordinances have two uses. They are educational and they impress some offenders who are ignorant of the common law. Ordinances may be hindrances, as where a city ordinance regulating the care of manure pits was so worded that it did not efficiently stop fly breeding. For this reason an ordinance should put greater emphasis upon the object sought than on the method. It should specifically state that a fly breeding place is a public nuisance. It may better end with that, rather than provide methods of care which are not surely effective.

Efficient administration requires that the inspecting officer knows thoroughly the entire subject. He must know how to recognize the eggs, the larva and the pupa, and how to find them. He must know the difference between the pupa case and the pupa. A city inspector made many trips to a dairy barn but could discover no source for the fly nuisance.

There was a cement pavement extending from the barn to beyond the manure box. An expert found multitudes of larvae in the inch of space between the barn and this pavement, and in the earth where the wagon was loaded, and where some manure fell, and which received the drainage from the pavement and pit.

PREVENTION OF BREEDING.

STABLES SHOULD BE well constructed and kept clean. The stable yard, at least near the barn, or the entire yard in a city, should be paved with brick or cement, leaving no place for fly breeding.

Manure pits should be tightly constructed, with brick or cement base, and should be *cleaned* at least once each week from the first of May until the middle of October, unless the contents be treated by efficient fly killing methods to be later described. If the sides of the pit be not tight, or if the cover be loosely applied, flies get in and lay their eggs. The drainage from the pit and the yard should either be conducted into sewers or into a cistern. This drainage is valuable for manure, and it is often advisable to collect it for this purpose.

In villages and upon the farm it may be advisable to use larval traps, to be described later.

Garbage should be collected in metal or stone receptacles which should be emptied frequently and washed out once a week in hot weather.

No garbage should be piled on the ground nor kept in wooden boxes which become soaked.

Piles of wet paper, wet straw and lawn clippings should not be permitted.

DESTRUCTION OF LARVAE.

ALARGE NUMBER OF EXPERIMENTS have been made in the chemical treatment of manure and other fly breeding substances to determine how the larvae may best be killed. The points to be considered are efficiency, cost and possible injurious action. It is not generally advisable to depend upon any treatment, but sometimes such temporary use of larvicides may be useful in addition to the more radical care in construction and emptying of pits. The trouble is that any system of treatment is not automatic but requires constant and intelligent application; and carelessness in use may reduce effect to a minimum.

The arsenical dip used for eradicating ticks from cattle and sheep when used in proportions of ten gallons of the dip to eight bushels of manure killed 88 per cent of the larvae. Paris green in proportion of one ounce to ten gallons of water is advised by McCormick of Asheville, N. C., who estimates that its free use on fresh manure not only kills the larvae, but it saves one-third of the fertilizing value of the manure from being destroyed by the maggots. It must be remembered that arsenic (and therefore Paris green) is a poison, and where there are chickens or other fowls harm may result from this treatment of manure. It is good treatment for privy vaults, but not so good as chlorinated lime (commonly called chloride of lime).

The chief objection to the use of chlorinated lime for manure is that when used in efficient quantities it is expensive and reduces the fertilizing value of the manure. On the other hand its bactericidal action recommends it for use in privy vaults, especially when there may be a liability to typhoid infection.

The U. S. Department of Agriculture recommended the daily use of borax in proportion of a pound to ten gallons of water, sprinkled on eight bushels of manure. This was found to kill 99 per cent of the larvae, but it is without effect upon the pupae or mature flies. When used in large quantities borax may be injurious to vegetation. It is relatively inexpensive.

Later the department advised the use of half a pound of powdered hellebore in ten gallons of water. It is slightly less efficient and slightly more expensive than borax, but is not injurious to plants nor to young chickens.

All of these methods must be regarded as temporary makeshifts, but either may be chosen when fly-infested manure is necessarily exposed.

BURYING.

THOSE NOT INFORMED often imagine that by putting the infested manure out of sight they get rid of the problem, and because the larvae disappear soon after manure is spread on the ground they think the larvae have been killed. In reality it is natural for the larvae to burrow in the earth as soon as they reach their full growth; and they develop more rapidly in warm but not too hot surroundings. Covering larva infested manure with earth is just the treatment flies enjoy. Experiments have demonstrated that flies will emerge from the surface of the ground when the maggot infested manure has been *buried six feet deep*.

LARVAL TRAPS.

IN COUNTRY DISTRICTS the use of larval traps is recommended. They are from 61 per cent to 76 per cent efficient and preserve the fertilizing value of the manure. Their use is advisable on farms but not in the cities.

Remembering that when the larvae have finished feeding they dig downwards to seek the earth, maggot traps are constructed of a framework to hold the manure, set over a concrete floor covered with from half an inch to an inch of water. The following description of the trap and method of operation is taken from Bulletin No. 200 of the U. S. Department of Agriculture:

"The maggot trap is designed and constructed as follows. First, a concrete floor was prepared 22 feet long and 12 feet wide. Around this floor was a rim or wall of concrete 4 inches high and 4 inches thick. An outlet pipe 4 inches in diameter was fitted in one corner toward which the floor sloped a little so that water would run out easily. Water was retained in the concrete floor by stopping the pipe outlet with a plug of soft wood. The pipe outlet led to a small cistern 5 feet square and 4 feet deep, the walls and floor of which were made of concrete. Standing

on the floor of the concrete basin was constructed a wooden platform 20 feet long and 10 feet wide, supported on legs 1 foot high. The framework of the platform was made of 2 by 4-inch studding. There were 6 of these pieces running lengthwise 2 feet apart, and one fastened across each end. Each of the long pieces was supported on four legs set at intervals of nearly 7 feet. Across the top of the framework were nailed strips 10 feet long by $1\frac{1}{4}$ inches thick and 1 inch wide. These strips were nailed 1 inch apart. Figure 8 shows most of the details of construction. Figure 9 gives another view, including also the outlet pipe (in this case consisting of 4-inch terra cotta) and the pump in place over the cistern.



Fig. 8. Larvae trap. (U. S. Department of Agriculture.)

Each day, after the addition of manure and litter from the stable, the manure on the platform was sprinkled with enough water to moisten it thoroughly without causing any leaching. Water was run into the concrete basin below the platform, so that the floor beneath the manure covered to a depth of $\frac{1}{2}$ inch in the shallowest part. Larvae migrating from the manure dropped into the water below and were drowned.

"At least once a week, and sometimes oftener, the water was drawn off from the basin into the cistern and the floor was washed clean by a strong stream of water from a hose." Figs. 8 and 9.

Where sawdust or shavings are used for bedding the cross strips must be put closer together to keep the manure from falling through.

Such a trap put into operation in August almost immediately reduced the number of flies at the garbage pail, and in the kitchen and stable.

The horses fed more quietly, and no longer kept up their frantic stamping to get rid of the flies.



Fig. 9. Larvae trap, showing cistern with pump. (U. S. Department of Agriculture.)

If the chickens or turkeys have access to the place they will eagerly devour the drowned larvae. Sparrows also enjoy them. The contents of the cistern are valuable for fertilizing irrigation.

NATURAL ENEMIES.

BIRDS, INCLUDING BARNYARD FOWLS, are natural enemies of flies. They feed upon the larvae and upon the winged insects. Toads and snakes are also efficient aids in thus exterminating the pests. Many other insects prey upon flies.

CARE UPON THE FARM.

BY THE USE OF THE LARVAL TRAP during the summer the number of flies may be materially reduced upon the farm. This is especially necessary, and not simply advisable, upon dairy farms. Every dairyman knows that his animals thrive better when relieved of these annoying pests. It is advisable also that the cow stables, and especially milk houses, be thoroughly screened at every opening. This means that the screens must be so carefully fitted as to prevent flies from entering through cracks around the frames.

Another thing which is frequently overlooked, though it is important, is that flies will continue to develop when the manure is taken from the

maggot trap to the field in the summer. Therefore during the summer such manure should be hauled to parts of the farm distant from the house and stable and it should not be left in piles near where the cattle are pastured, *nor near to the path by which they pass*. If this latter point is neglected, the cattle will attract the flies as they pass the piles of manure and transport them to the stable.

FLY TRAPS.

IN SPITE OF PRECAUTIONS, flies may be produced. A few may be killed by "swatting." More may be caught by traps. Fly traps, though numerous in design, are all based upon the habit of the fly to crawl upwards rather than downwards, and to seek the light. If the cover to the garbage can be sufficiently loose, the flies are attracted into the can by smell. A trap over an opening in the cover to the can gives them a glimpse of light which they follow to destruction. Such traps are especially recommended for all receptacles for the waste from meat shops and fish markets. Such a trap is shown in Figure 10.

FLY POISONS.

THE NUMBER OF FLIES in a house may be somewhat reduced by the use of sticky fly paper, but it is disagreeable to have around; or a few may be killed by the commercial poison fly paper, but accidental poisoning of children may occur.

Formaldehyde does not kill the flies but it so stupefies them that they may be swept up and burned. A convenient and efficient method is the following: Put a teaspoonful of the 40 per cent solution of formaldehyde in $\frac{2}{3}$ glass of water. Cover the glass with a piece of white blotting paper which has been cut to fit the bottom of a saucer. Put the saucer over the covered glass and then quickly turn all over so that the glass will be standing inverted in the saucer. The edge of the glass may be slightly raised by inserting a toothpick under it. If this is placed near an unshaded window early in the morning, the drunken flies may soon be brushed up and burned.

SCREENING.

It should not be necessary in any civilized community to screen dwelling houses against flies. The prevalence of flies is evidence of the slovenly habits of the people and of the incompetence and negligence of the local officials.

On the other hand, every milk depot, every meat shop, every fish market, restaurant, soda stand, bakery, fruit or candy store and grocery, should be effectually screened during the summer months to exclude the few flies which may be found. It is especially necessary that all privies be screened, and it is more important that the ventilating openings into the vault be covered with netting than it is to screen the windows. Flies in the privy itself are an annoyance, but if they gain entrance to the vault they become a peril to the community. Of course it is necessary that the seat be provided with close-fitting and self-closing lids.

WINTERING OF FLIES.

A FEW FLIES MAY POSSIBLY PASS the winter in secluded cracks and corners, but Hewitt thinks that most of them pass the winter in the pupa stage. It is improbable that eggs which fail to hatch in the fall maintain life through the winter, but the pupas, or grubs as



Figure 10. Fly trap on garbage can. (From Howard, "The House Fly.")

they are called in England, are well fitted to protect the life of the insects and thus enable them to appear in the spring. Most of them pass the winter in the earth.

NOTE.

The basis of this discussion is the life of the ordinary housefly. Though there are many varieties of flies, each with its special peculiarity of habit, there has generally been no effort to distinguish between them. It is chiefly flies whose habits are like the housefly that are dangerous, and the methods of warfare suggested apply to the class as a whole.

Q. Is it really true that flies are a danger to health?

A. Yes, they have been proven able to carry the germs of many forms of disease.

Q. Granting that they might do so, do they in fact often cause disease?

A. Yes. They are a large factor in the spread especially of intestinal diseases.

Q. If they were really so dangerous wouldn't we all be dead?

A. By the same argument we should all be dead from poisons, for in every community there are enough poisons to kill the entire population. The fact is that in many ways nature tries to protect us, and generally she succeeds pretty well. People, however, generally know the dangers from poisons, and they should know the danger from flies.

Q. How many flies may be produced from a single pair during a year?

A. Howard estimates conservatively that if the first batch of eggs is laid April 15, according to weather conditions at Washington, D. C., by September 10, a total of 5, 693,613,559,320 flies may have been hatched. If these flies should be placed end to end they would make a procession approximately 30,000,000 miles long, or with thirty abreast there would be a solid line a million miles long.

Q. Do you mean that so many flies are actually produced?

A. Certainly not. By disease and other natural means most flies are exterminated. If the early flies are exterminated, there will be none to kill in the latter part of the summer.

Q. How can flies be exterminated?

A. By eliminating the breeding places.

Q. Will the solution of the garbage question do this?

A. No, it will help, but only very slightly.

Q. What then should be done?

A. Prevent the storage of manure, waste paper, wet straw and cloth, and prevent the soaking of ground from manure and garbage.

Q. But there are always more flies around garbage than around manure piles.

A. Yes, the flies eat garbage, but the eggs hatch and maggots live in the manure. There are thousands of maggots in manure to every one in garbage.
